The Impact of Safety Climate on Malaysian Seafarers’ Safety Performance: A Pilot Study

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Abstract
Research has shown that safety climate predicts safety performance in a variety of settings. Safety climate study in the shipping industry is in the early phase and still growing. This research accordingly aims to examine the effects of safety climate towards safety performance among Malaysian seafarers. Through purposive sampling, a pilot study with a sample size of 50 respondents from among the seafarers working on various types of commercial ships based in Peninsular Malaysia was conducted. Accordingly, Exploratory Factor Analysis, Cronbach Alpha and multiple regression analysis were conducted to analyse the impact of safety climate on safety performance. In terms of the validity and reliability of items measurement of the questionnaire, the result indicates some level of significance and that the questionnaire is ready to be used for the actual study.

Keywords: Safety climate, safety performance, seafarers, safety participation, safety compliance.

Introduction
The shipping industry has contributed a total of 90 per cent of the world trading (Batalden & Sydnes, 2014; Chan, Hamid, & Mokhtar, 2016; Chauvin, Lardjane, Morel, Clostermann, & Langard, 2013). Lu and Tsai (2010) confirmed that within the commercial shipping industry, safety at sea is a serious issue and is ranked the topmost of all assessment of risks including vessel and cargo loss or damage, crew injuries or fatalities. Thus, the shipping industry is the most international of all the world’s great industry and is one of the most dangerous (Chan et al., 2016; Hetherington, Flin, & Mearns, 2006; Veluplay, Mokhtar, Ahmad, & Halim, 2014). The shipping industry has experienced a substantial number of incidents and these include collision, contact, grounding, foundering, fire, capsizing and sinking (Chan et al., 2016). In 1987, the Herald of Free Enterprise (1987) vessel capsized due to the captain’s negligence in ensuring that all the doors were closed during sailing. There is also the case of Estonia (1994) where a passenger ship sank in the Baltic Sea and caused 852 fatalities (Ruponen, 2007). Other cases involving passenger ship are
Titanic (1912) and 100 years later, the Costa Concordia (2012). Ships that resulted in oil spills such as the Torrey Canyon, Amoco Cadiz, Exxon Valdez, Erika and Prestige had affected a large area of the coast and had led to many changes in the International Maritime Organization (IMO) regulations. These major incidents were of public interest and resulted in the loss of human lives, property and damage to the environment. Most previous studies have evaluated trends of accident records as a lagging indicator of safety performance in improving safety climate (Givehchi, Hemmativaghef, & Hoveidi, 2017). Such indicator has become an important foundation for assessing the safety and is considered to be a leading indicator of safety performance (Zohar, 2010). Previous research has also shown that a positive safety climate is associated with improved safety practices (Zohar, 1980), a decrease of incidents (Mearns, Whitaker, & Flin, 2003) and the practice of less unsafe behaviour (Hall, Blair, Smith, & Gorski, 2013).

Safety climate had been studied in many industries such as food processing, road drivers, firefighting, manufacturing, trucking, construction, oil and gas as well as health nursing (Al-Zubaidi & Imamoglu, 2017; D. Ali, Yusof, & Adam, 2017; Awal & Hasegawa, 2017; De Boeck, Jacxsens, Mortier, & Vlerick, 2018; DeJoy, Smith, & Dyal, 2017; Gunaseelan & Gerald, 2017; Huang et al., 2014; Kvalheim & Dahl, 2016; Murphy, Robertson, Huang, Jeffries, & Dainoff, 2018; Olsen & Bjerkan, 2017; Saunders et al., 2017; Silla & Gamero, 2018). However, very limited research was done relating to the shipping industry (Lu & Tsai, 2010). Although there are many studies on the antecedents of safety climate, there is still a lack of understanding on seafarers’ perceptions of safety climate and its relationship with accidents at sea (Lu & Tsai, 2010). Therefore, this study aims to test the validity and reliability items measurement of the questionnaire and influences of safety climate dimensions on safety performance.

Literature Review

Safety climate is defined as the coherent set of perceptions and expectations that employees have regarding safety in their workplace (Zohar, 1980). Neal, Griffin, and Hart (2000) identified safety climate as a specific form of organizational climate which describes individual perceptions of safety in the working environment. Research has also shown that safety climate predicts safety behaviour and safety outcomes (Huang et al., 2014). A range of dimensions has been identified as being
important components of safety climate. These dimensions include supervision, safety focus, safety communication and feedback, co-worker support for safety, training and recognition (Alnoaimi, 2015).

Supervision is measured in an organization safety climate where the perception, attitudes and behaviours are related to safety (Alnoaimi, 2015). It is measured by respondents' satisfaction with the supervision about safety and how the seafarers experience to support and understanding from their supervisors onboard the ship. Studies have shown that employees with high-quality supervisor relations have more positive climate perceptions rather than those with low-quality supervisors (Alnoaimi, 2015). According to Zohar (2000), supervisory practices were shared among individuals within groups and aggregate perceptions of supervisory practices could predict accidents at the individual level.

Safety focus is an organization or ship's commitment to safety (Alnoaimi, 2015). Specifically, it is about the safety management of a ship such as safety policies and safety equipment including life raft, lifeline, lifebuoy and other related safety equipment. Safety focus in shipping has been on technical improvements and most of the seafarers working with shipping companies have a technical background. As a whole, the technical focus had improved the ship safety but there are more to focus on such as the improving safety culture and improving training schemes (Berg, 2013). This study has measured the seafarers' satisfaction and attitudes towards the safety onboard ships. Safety communication refers to information sharing in the organization (Alnoaimi, 2015). In the seafaring environment, good communication is very important as a misled in communication may lead to disaster. According to Riggio and Taylor (2000), good communication is considered as a foundation for organizational success. Besides providing knowledge, management needs to provide skills and abilities to effectively communicate their knowledge to complete their task (Alnoaimi, 2015). A seafarer must be trained to perform the ability to communicate effectively and able to exchange information in carrying out their responsibilities (Chira-Ungureanu & Visan, 2011).

Recognition will promote safe behaviours and reduce unsafe behaviours at work (Alnoaimi, 2015). Brun and Dugas (2008) examined the impact of motivation to work on performance and highlighted that recognition is a component of motivation and motivation is the predictor of organizational performance. Hence, a lack of recognition will result in psychological distress in the workplace and harms productivity and
performance (Brun & Dugas, 2008). Employees feel appreciated when their work is recognized. On top of that, they will have a positive safety climate and will be much more motivated to improve safety at work (Alnoaimi, 2015).

Co-workers are important in supporting safety information and new safety rules and they also are very important in influencing the workers’ risk-taking behaviour and when safety-related exchanges are minimal, co-workers may be less willing to intervene in the face of potential hazards (Tucker et al., 2008). Support from the co-worker may influence safety-related communication and safety regulations at work (Alnoaimi, 2015). Safety focused support from co-workers can reduce hazard at the workplace (Turner et al., 2010). A co-worker will influence safety-related communication, risk-taking behaviour and safety regulations (Alnoaimi, 2015).

Training is important for seafarers. Although a seafarer had experienced more than ten years, he must attend training to improve and be competent. Standard of Training, Certification and Watchkeeping (STCW) is a requirement for all seafarers. STCW was adopted to improve the competency of the seafarers worldwide (A. Ali, 2006). Besides that, safety training is important when measuring safety climate and is a high predictor of safety behaviours (Cooper & Phillips, 2004).

The employees’ safety climate perception is more predictive of safety outcomes that the safety climate interpretations of the supervisors themselves (Huang et al., 2014). Accordingly, this study seeks to evaluate the effects of safety climate on safety performance from a seafarer’s perceptive.

**Methodology**

The data was collected from 15th January to 2nd March 2017 with 50 respondents as the participants through a personally assisted survey and using a structured questionnaire. The population for this study was seafarers who are attached to commercial ships in Malaysia. Purposive sampling technique was applied and all 50 participants were active seafarers working on board those ships. The survey was carried out in Port Klang and also onboard a Malaysian ship, MV Nautical Aliya during the voyage from Port Klang to Myanmar and Bangladesh for the Food Flotilla for Myanmar mission. Such manner would ensure that the respondents understand all the questions in the survey. The survey was conducted during their break and off time to ensure that there was no interference or influence from their superior. According to Ruel, Wagner III, and Gillespie (2016), the rule of thumb for an ideal pilot test is within
the range of 30 to 100 participants, depending on the number of respondents in the study. To prevent mistakes or defects in the pilot test, some pre-planning and actions were conducted. The respondents selected were experienced seafarers whereby a total of 48.0% of them have more than 10 years of experience in sailing. There had been no interference from their supervisors. The pilot test was conducted solely by the researcher without the presence of any enumerators to ensure that the respondents were clear in their responses and also to assist them in any difficulty.

**Results**

Using the Statistical Package for Social Science (SPSS) Version 24, below are the related results.

1. **Descriptive Analysis**

From the total of 50 sample size, all of the respondents were male (100 per cent) with the majority are married (70.0 per cent) and are in the age group of 30-39 years old (44.0 per cent). Majority of the respondents (62.0 per cent) has a Diploma for their academic qualification. The majority are in the job category of Masters and Watch Keeping Officer (18.0 per cent each) followed by 14.0 per cent being Deck Rating rank. In terms of the ship classes, 44.0 per cent are in the ‘other’ class which represents domestic ships namely Malaysian ships. In terms of experience, a majority of 26.0 per cent of them have experience of 10-15 years of service as a seafarer. Half of the respondents have experience working in the same shipping company and a majority of 78.0 per cent has been working on the same vessel for less than three years. A total of 62.0 per cent are on a three months duration contract service while a total of 76.0 per cent of the respondents does not work on the same vessel for every sailing period. A majority of them (23 respondents) works on a 6 hours work-6 hours off basis.

In terms of being involved in maritime incidents at sea, 24.0 per cent of the respondents have experienced collision, 28.0 per cent experienced grounding, 10.0 per cent experienced sunk, 46.0 per cent experienced fire onboard ships, 26.0 per cent experienced man overboard, 10.0 per cent experienced missing/drifting and 8.0 per cent experienced capsized. A total of 58.0 per cent (29 respondents) did not experience any form of accidents before.
Further information had been obtained to understand the characteristics of the sample better such as the Skewness and Kurtosis value (Table 1). Skewness value indicates the symmetry of the distribution. Kurtosis provides information about the peakedness of the distribution (Pallant, 2010). With a reasonably sufficient number of 50 respondents (Table 1), it depicts that the distribution is considered perfectly normal when both Skewness and Kurtosis values are closer to 0 (Pallant, 2013). The ranges of acceptability for both skewness and kurtosis lie between ±3.92 to ±2.62, as supported by Jamali (2017). For this study, the range group age of all samples is 18-69 years with a mean 2.14 which is in the range of 30-49 years old and standard deviation of 0.969.

### Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>50</td>
<td>1</td>
<td>5</td>
<td>2.14</td>
<td>0.969</td>
<td>0.970</td>
<td>0.337</td>
</tr>
<tr>
<td>TSP</td>
<td>50</td>
<td>39</td>
<td>65</td>
<td>57.60</td>
<td>6.395</td>
<td>-0.654</td>
<td>0.337</td>
</tr>
<tr>
<td>Valid N</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(listwise)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Validity-Instrument

In terms of face validity of the questionnaire, the instrument has been endorsed by academic experts in seafaring and specifically two academics with teaching experience of more than ten years in their respective fields. These two experts who voluntarily agreed to be the reviewers are from Universiti Teknologi Malaysia (UTM) Malaysia and Universiti Malaysia Terengganu (UMT) Malaysia. The questions were reviewed and vetted in the form of item correlation and consistency in the subject matter. All comments and suggestions were taken into consideration before the commencement of this study.

3. Normality Test

Assessing normality here is through the p-value of Kolmogorov Smirnov and Shapiro-Wilk for the dependent variable Total Safety Performance, as shown below. The Kolmogorov-Smirnov p-value of the scores here indicates more than 0.05 (at a
95% Confidence Interval) i.e 0.054, thus indicating a slightly reasonably normally distributed scores (Pallant, 2013). However, the score of Shapiro-Wilks does not show such. This may be due to small sample size i.e 50 respondents.

### Table 2: Normality Test

<table>
<thead>
<tr>
<th>Kolmogorov-Smirnov&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statistic</strong></td>
<td><strong>Df</strong></td>
</tr>
<tr>
<td>TSP</td>
<td>0.124</td>
</tr>
</tbody>
</table>

<sup>a</sup> Lilliefors Significance Correction

In the following probability plot, the data forms an approximately straight along the line (Fig. 1). It illustrates the distribution appears to be a good fit to the data. It tends to fall closer and has right-skewed data distributed. The boxplot also depicts upper whiskers and indicates that there are no extreme outliers. However, the distribution of the data, the boxplot is relatively tall leading towards the upper whisker.

![Figure 1: Q-Q Plot of Total Safety Performance](image)

4. Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) was applied in this study to group the criteria according to the Safety Climate instrument. EFA is a data reduction technique used in the early stage to reduce a large number of variables to a small set of factors that groups the information contained in the variables (Pallant, 2013). A Kaiser-Meyer-Olkin (KMO) test and Barlett’s Test of Sphericity were conducted to verify if the dataset
was suitable for factor analysis. The KMO index should range from 0 to 1, with 0.6 as the minimum value for good factor analysis and Barlett’s Test of Sphericity should be significant (p<0.05) for the factor analysis to be considered appropriate (Tabachnick & Fidell, 2007). EFA was conducted on the 44 items with varimax rotation. All six independent variables were used to establish a pattern of structure and create a scree plot. As depicted in Table 3, KMO values were 0.6 and Barlett’s Test of Sphericity was significant (p=0.000).

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</th>
<th>Approx. Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.600</td>
<td>1453.7</td>
<td>28</td>
<td>0.000</td>
</tr>
<tr>
<td>Bartlett’s Test of Sphericity</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As a result, nine factors had eigenvalues more than one, presented in the scree plot in Fig. 2. In short, 44 item structures were found to explain 68.346 per cent of the variance in the data as shown in Table 4.

![Scree plot](image)

Figure 2: Scree plot

The second criteria accounted for 42.012 per cent of the total variance with an eigenvalue of 3.346, the third criteria accounted for 50.305 per cent of the total variance with an eigenvalue of 2.903, the fourth criteria accounted for 57.952 per cent of the total variance with an eigenvalue of 2.676, the fifth criteria accounted for 64.014 per cent of the total variance with an eigenvalue of 2.122 and the six criteria accounted for 68.346 with an eigenvalue of 1.516.
Table 4: Total Variance Explained

<table>
<thead>
<tr>
<th>Comp</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total % of Variance</td>
<td>Cumulative %</td>
<td>Total % of Variance</td>
</tr>
<tr>
<td>1</td>
<td>11.35</td>
<td>32.451</td>
<td>11.358</td>
</tr>
<tr>
<td>3</td>
<td>2.903</td>
<td>8.293</td>
<td>2.903</td>
</tr>
<tr>
<td>4</td>
<td>2.676</td>
<td>7.647</td>
<td>2.676</td>
</tr>
<tr>
<td>6</td>
<td>1.516</td>
<td>4.332</td>
<td>1.516</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.

5. Reliability Test and Regression Analysis

The Cronbach's alpha values of the determinants in the study areas are shown in the summary table below. The scores indicate reliability values that are higher than 0.7, meaning that all the determinants used in the study have a relatively good measure of internal consistency (Sekaran & Bougie, 2016). They are then suitable and can be accepted as a measurement tool for the final analysis. Table 5 depicts the Cronbach’s Alpha values for all the variables and gives a result of more than 0.7 except for the second independent variable (Total Safety Focus).

Table 5: Summary of Cronbach’s Alpha Value for the Variables

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>No. of Items</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Supervision</td>
<td>9</td>
<td>0.928</td>
</tr>
<tr>
<td>Total Safety Focus*</td>
<td>5</td>
<td>0.565</td>
</tr>
<tr>
<td>Total Safety Communication &amp; Feedback</td>
<td>12</td>
<td>0.892</td>
</tr>
<tr>
<td>Total Recognition</td>
<td>5</td>
<td>0.843</td>
</tr>
<tr>
<td>Total Co-Worker Support for Safety</td>
<td>5</td>
<td>0.904</td>
</tr>
<tr>
<td>Total Training</td>
<td>7</td>
<td>0.904</td>
</tr>
<tr>
<td>Total Safety Performance</td>
<td>13</td>
<td>0.935</td>
</tr>
</tbody>
</table>
Initially, questions 3, 4 and 5 in the Total Safety Focus were categorized as reversed questions. Due to low loading value, these questions have been rephrased to simplify the language and its meaning to avoid from being confused in responding to the question.

Cronbach Alpha shows all variables are within the acceptable range more than 0.70 (Pallant, 2013) except for Total Safety Focus which has a value of less than 0.7.

A multiple linear regression analysis was applied to predict which independent variable that best explains the variance of safety performance. A significant regression equation was found (F(6,43) = 3.136, p<.05, with an adjusted R² of 0.207. This depicts that 20.7 per cent of the variance in safety performance is explained by the six independent variables namely supervision, safety focus, safety communication and feedback, recognition, co-worker support for safety and training while the balance of 79.3 per cent of the variance is explained by other factors not covered in this research. This result is acceptable as the number of samples is small.

Discussion

The study shows that it is necessary to improve the seafarers' safety climate to develop a safe shipping environment. For the research of safety climate, it is necessary to grasp the seafarers' dimensions regarding safety climate and safety performance and how it leads to accidents at sea. The contents of the questionnaire regarding safety climate are uniquely presented and the common dimensions of the safety climate were covered: supervision, safety focus, safety communication and feedback, co-worker support for safety, training and recognition are also common scales of safety climate in other industries other than shipping. The reliability of the instrument is found to be acceptable with majority of the variables has a Cronbach's alpha and composite reliability value of above 0.70 (Hair, Ringle, & Sarstedt, 2011; Pallant, 2013).

Conclusion

The results of this study are expected to help contribute to determining the appropriate dimensions of seafarers' safety climate for future studies. However, the factors we hypothesized were not definitively extracted. There is a need then to continue to improve the questionnaire of the safety climate, especially in the safety focus dimension. With the acceptable results in terms of its validity and reliability, this
instrument can be used then for the actual survey and on much bigger sample size. The result on the association between the dimensions of the safety climate and safety performance should provide further insights on the importance of understanding seafarers' safety as well as indicating actions that can reduce maritime accidents in the future.

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